DETACHABLE MAGNET HOLDER

[0001] The invention relates to an universally applicable detachable magnet holder which is suited for closing and opening of containers or capable of holding and detaching of an object.

[0002] Detachable magnet holders using the magnetic holding power of permanent magnets are known from prior art. If the magnets are arranged so that, in the closed state, the magnet poles having different polarities are opposite to each other, and, in the open state, the magnet poles having the same polarity are opposite to each, it is possible to obtain an especially effective closed state and self-acting opening and releasing, respectively. This prior art is described for example in the documents DD 97706, BE 669664, DE 2323058, DE 29622577 and DE 8902181.

[0003] Such kinds of magnet holders or closing devices have been used in practice in special cases only, as common magnets had a relatively big size and a great weight. At present, high-duty magnets generating remarkably stronger holding power are available, so that magnet holders or closing devices smaller in size and lower in weight can be produced. At the same time, new fields of application open up. However, up to now, the occurrence of magnetic shear forces has not been discussed or constructively considered. Magnetic shear forces are to be considered as forces which are generated when the magnet poles having different polarities are opposite to and mutually repel each other and dislocate the magnets to each other laterally.

[0004] Another problem arising with high-duty magnets is the great holding power thereof, which, on the one hand, is wanted, but on the other hand, renders an easy separating of magnets more difficult.

[0005] Therefore, object of this invention is to provide a detachable magnet holder, which can be opened easily and, at the same time, can be made in a miniaturized design, in spite of the fact that strong magnetic forces will act onto it.

[0006] This object is gained by a magnet holder according to claim 1. This magnet holder comprises a fixedly arranged magnet and an opposite-lying magnet rotatable about a point of rotation. Each of the magnets has a magnet pole surface (A_1, A_2) comprising two poles at least. In the closed state, the corresponding poles having different polarities are opposite to and attract each other. In the open state, after rotating the rotatable magnet by means of an actuation device, the poles having the same polarity are opposite to and mutually repel each other.

[0007] A distance element made of a non-ferromagnetic material is fixed to at least one of the magnet pole surfaces, the bearing surface thereof on the opposite magnet pole surface (A_1, A_2) being 1/3 of this surface, as a maximum. This distance element has a dual function. Due to the small bearing surface, the friction force, which occurs with opening, is smaller than that occurring when both these surfaces contact each other totally. In addition, the distance element prevents the magnet surfaces from contacting each other directly, so that a more equal course of force is gained with the opening procedure. The thickness of the distance element is selected based on the holding power and course of force wanted for the opening procedure.

[0008] Furthermore, a centering engaging device is arranged in the vicinity of the magnet poles. This centering engaging device comprises elements matching each other and engaging in the course of closing, wherein the engaging portion is suitably formed to take up the shear forces, which occur with the opening procedure, until they are reduced to minimum value determined by the structure, as the distance between the magnets increases.

[0009] The combination of these features ensures the strong shear forces generated by high-duty magnets to be absorbed directly at the place of occurrence, so that a small-sized magnet holder low in weight can be made.

[0010] According to claim 2, the distance element is concentrically arranged relative to the point of rotation. This measure allows remarkably small friction forces to be gained.

[0011] According to claim 3, the distance element is also designed as a centering engaging device. The dual function of this structural element allows the shear forces to be received directly at the place of occurrence and a particularly small-sized design to be realized. At the same time, a hapticly favourable course of force is gained with the opening procedure.

[0012] According to claim 4, the distance element and the centering engaging device are made of a strong plastic material having a low coefficient of friction.

[0013] Below, the invention will be described by means of two exemplified embodiments.

[0014] FIGS. 1a and 1b show a first embodiment of the invention.

[0015] FIG. 2 shows the cross-section of a part of this embodiment.

[0016] FIG. 3 shows a second embodiment of the invention.

[0017] FIG. 1a shows an opened bow holding device for holding a stringed instrument bow. The magnet holder according to the invention, which is comprised

of two pairs of magnets 3a, 3b and 4a, 4b respectively, is arranged on the bottom part 1 and on the pivoting upper part 2 of the bow holder, wherein the magnets 3a, 3b are fixed, whilst the magnets 4a, 4b can be rotated about a point of rotation 6 by an angle of about 100 degrees by operating a lever 5. The distance element is marked by a reference mark 7. The distance element 7, the axis of which is in line with point of rotation 6, prevents the magnet poles of different polarities from contacting each other, when they are opposite to and attract each other in the closed state. With this exemplified embodiment, the distance element 7 is a flat cylinder made of Teflon, which has a diameter of 3 mm and a thickness of 0.4 mm. An expert certainly knows in which way a rotatable magnet is held in case, so that no further explanation is necessary, but reference is given to FIG. 2 only, which shows the arrangement and support of the rotatable magnet within the case 8.

[0018] The magnets are dimensioned so that, with the closing procedure, the pair of rotatable magnets automatically rotates to the closed position, that is, by magnetic forces only, where the magnet poles having different polarities are opposite to each other. When the lever 5 is operated to rotate the pair of magnets 4a, 4b, the force keeping the bow holder closed is gradually reduced to zero and then changes into a gradually increasing repulsive force which opens the bow holder.

[0019] During the opening and closing procedure, shear forces also are generated, which cause the opposite-laying magnets to displace to each other laterally. This phenomenon can clearly be observed when trying to manually lay two magnets having the same polarity on each other. The shear forces apply a torque to the joint 9 via the top and the bottom part of the bow holder, which increases with the length thereof, that is, with length of the lever arm. This torque must be received by the joint. In order to prevent this, the invention comprises a centering engaging device 10. With this exemplified embodiment, the centering engaging device 10 comprises projections 10a which, in a predetermined phase

before the bow holder is completely closed, slide into recesses 10b and thereby, receive the shear forces approximately there where they are generated.

[0020] The arrangement shown in FIG. 3 is the same as that in FIG. 2, with the exception that the distance element and the engaging element have other configurations. The distance element 7 and the centering engaging device 10 have been optimally united into a cylindrical plug connection 11 having a centering cone 12, which accomplishes the dual function mentioned above and receives the shear forces symmetrically with respect to rotation.

[0021] The structure and the magnet power are dimensioned so that, when the magnet holder is opened, the centering engaging device 10 remains engaged until the shear forces have reduced to a predetermined value.

[0022] In summary, it must be stated that the structure shown in FIG. 3 is the best embodiment of the technical theory.

[0023] An expert in this field certainly knows that, based on the disclosed theory, the configuration of the magnet poles, the distance device and the centering engaging device can be altered in numerous ways. Therefore, it is possible to provide a magnet holder for several applications, e.g. for closing and opening of a vacuum jug, a powder-box with a mirror or a spectacle-case, which does not wear and the haptic properties thereof can be realized easily and exactly.